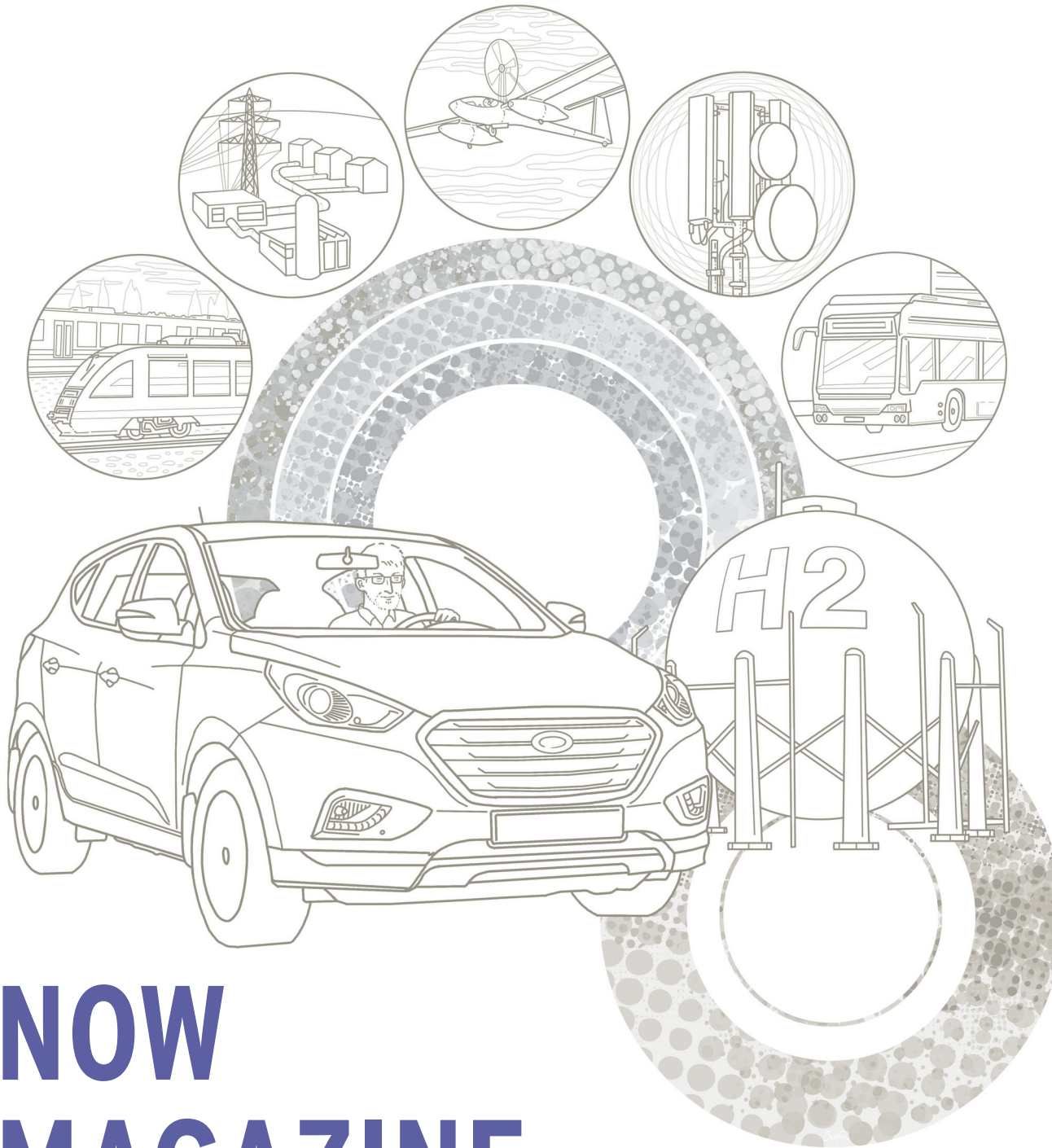
NOW
National Organisation Hydrogen and Fuel Cell Technology



NOW MAGAZINE 2015

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FOREWORD BY ALEXANDER DOBRINDT

The world has been facing the greatest mobility revolution since the invention of the automobile: Automated and connected driving is on the rise – and the turnaround in drivetrain technology towards electric mobility has begun. Together with the industry we have set ourselves clear objectives: We want to become the lead provider and the lead market in this field and will put one million electric vehicles on German roads by 2020. The figures speak for themselves: We are moving in the right direction. With growth rates of 35 percent for electric vehicles and of 21 percent for hybrid vehicles as compared with the 2015 figures, we are currently experiencing rising dynamics. What is more, in the meantime German manufacturers have placed about 30 electric models on the market. Thus, our automotive industry is offering the greatest variety of models all over the world.

Promotion of electric mobility by billions of euros

Proof of this is also furnished by a McKinsey Study which shows: Today, Germany as a manufacturing country is already a market leader and, with a market share of almost 40 percent, can become the largest production site by 2020. We want to support our enterprises in their efforts and ensure that the market ramp-up is successful. This is why we have in the last few years already invested 2.6 billion euros into the promotion of electric mobility. This is why we have adopted an Electric Mobility Act in 2015, providing for a new e-licence plate and the possibility of granting privileges to electric vehicles in road transport. This is why we have already invested 500 million euros into the promotion of the hydrogen and fuel cell technology and will continue our commitment at an all-time high with 161 million euros in the period from 2016 to 2018. And this is also why we support more than 650 individual projects in our showcases and model regions by providing more than 350 million euros. It has become apparent here: Electric mobility is fit for everyday use – and offers great potentials in passenger transport as well as in urban commercial transport.

Increasing dynamics by an area-wide charging infrastructure

It is now necessary to boost the dynamics of electric mobility. The key factor here is the installation of an area-wide charging infrastructure. Users need the confidence to be able to charge their vehicle everywhere and at every time. Therefore, we intend to set up an additional 15,000 charging points in Germany and for this purpose, together with the industry, to invest a total of 300 million euros. In order to make electric cars cheaper and, thus, more interesting we also need a functioning second-hand market and enterprises willing to change over to an electric fleet. We as the Federal Government are at the forefront of this development and already today approximately 40 percent of the vehicles used by my Ministry are electrically driven. At the end of this year, this figure will be 50 percent.

The future belongs to electric mobility. We have already achieved a great deal in this field. In this respect, the National Organisation for Hydrogen and Fuel Cell Technology (NOW) was and still is an indispensable partner and catalyst.

I am convinced: We invented the car. We have revolutionized it time and again. And now, as the innovation leader in the field of mobility, we will successfully implement the turnaround in drivetrain mobility.

Yours

Alexander Dobrindt, MdB

Member of the German Bundestag
Federal Minister of Transport and Digital Infrastructure

FOREWORD BY DR. KLAUS BONHOFF

Germany's energy system is undergoing a transformation – away from fossil fuels and towards renewable energies. Hydrogen, fuel cell and battery technologies are key technologies for integrating renewable energies into the energy sector and into the transport sector as electricity-based fuels. They offer huge potential for reducing emissions, raising efficiency and therefore make a major contribution to the international community's two degree goal. In Germany both the federal government and industry are investing together in the testing of these technologies and their products in everyday use in a strategic partnership which began in 2006.

The National Innovation Programme for Hydrogen and Fuel Cell Technology (NIP) and the Electromobility Model Regions were established specifically for the purpose of preparing the market. As the federal programme management association, NOW National Organisation Hydrogen and Fuel Cell Technology is responsible for the coordination of both programmes. In this task NOW sees itself as a neutral and open interface between politics, industry and science. It initiates, evaluates and accompanies concrete projects. It moderates the strategic orientation of programmes in the NOW Advisory Board, where representatives of all participating industry sectors, of science as well as the federal ministries are included. In addition to the core business of specific project work, NOW also serves as a platform for the formation of industry alliances on particular issues, networks players, carries out PR work for the technologies and is active in an international context on behalf of the federal government.

Furthermore NOW ensures results from project work and accompanying scientific research are evaluated and disseminated and also fosters international cooperation. Since 2015 NOW is also tasked by the BMVI with working out national strategic plans within the EU's *Clean Power for Transport* package of measures.

NIP – the year in numbers

In 2015 a total of 71 new projects with funding of 55.7 million euros were approved under the National Innovation Programme for Hydrogen and Fuel Cell Technology (NIP); the overall budget of the projects including the industry share totalled 123.2 million euros. Since the operative start of the NIP programme in 2008, 405 projects in all were approved by the BMVI and BMWi with a funding volume of 441.7 million euros (total budget of 925.5 million euros). There are 192 companies behind the grant applications. Including commissioned subcontractors and suppliers, an economic sector of around 500 companies in the hydrogen and fuel cell technology area was activated through the NIP stimulus.

In terms of individual application areas, 2015 was characterised by the commercial market launch of some major product groups. In the stationary area the Callux practical trial came to an end. A key result is the significant cost reduction of the overall system over three device generations (minus 30 percent). From the three heating system manufacturers working on the development of a fuel cell heating system for domestic electricity and heat supply at the start of the project in 2008, today there are seven. Two have systems on the market today. In the hydrogen mobility area, the establishment and operative start of the H_2Mobility company set the course for the nationwide build-up of refuelling infrastructure. Regional coverage will be established over the coming years, which will facilitate the launch of fuel cell vehicles (first models are available since 2014/2015).

Electromobility Model Regions – the year in numbers

In the 2015 reporting year, 34 projects were newly approved in the Electromobility Model Regions, while 72 projects could be completed. The funding budget of approved and completed projects totalled 39.9 million euros. Building on the previous Electromobility Model Regions funding programme, the Federal Ministry of Transport and Digital Infrastructure (BMVI) published new funding guidelines to procure electric vehicles and to support municipal approaches to developing electromobility on a local level. The aim of the new funding is to increase vehicle numbers, particularly in municipal fleets as well as to build up the charging infrastructure needed, so as to strengthen the development of renewable energies for the transport sector on the municipal level.

In the accompanying research, managed by NOW, work ended in the seven thematic fields: User perspective, fleet management, innovative drives and vehicles, safety, infrastructure, regional, urban and transport planning as well as regulatory law. In the future the major scientific accompaniment of the project work will be continued in four overarching thematic groups: innovative drives and vehicles, infrastructure, framework conditions/market as well as interconnected mobility.

It's not just about batteries and fuel cells

Alternative fuels which yield little or no emissions, combined with efficient drives like electric engines will be a normal phenomenon in the transport sector in future. The framework for this development was drafted by legislators (95gCO_2/km by 2021, additional targets for 2025 or 2030 under discussion). At the same time the spheres of politics and science, integrating all involved stakeholders, have begun a process that is dedicated to achieving these goals and in the end to strengthen Germany as an economic and technological location. This also applies to efficient electricity and heat supply of single-family homes through the use of fuel cell systems.

On an international level, Germany is highly regarded in terms of its long-term, interdisciplinary and technologically open approach to fostering hydrogen, fuel cells and batteries while incorporating the needs of politics and industry. In this context the goal and mission of NOW remains to guarantee efficient innovation management of publicly funded research and development as well as market activation.

Dr. Klaus Bonhoff

Managing Director (Chair) NOW GmbH
National Organisation Hydrogen and
Fuel Cell Technology


DB
Alcatel·Lucent
HaCon
inno
RLI
Schneider Electric
Zukunftsbahnhof
Berlin Südkreuz
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ABOUT NOW

NOW GmbH (National Organisation for Hydrogen and Fuel Cell Technology) was founded in 2008 by the Federal Government, represented by the Federal Ministry of Transport and Digital Infrastructure (BMVI). The task of NOW involves the coordination of two federal development programmes – the National Innovation Programme Hydrogen and Fuel Cell Technology (NIP) as well as the Electromobility Model Regions and the ensuing electromobility funding guidelines of the BMVI. Both programmes serve to advance the market preparation of the corresponding technologies to ensure that mobility and the supply of energy in the future is efficient and environmentally friendly. Support focuses on research and development activities as well as demonstration projects that present the deployment of the technologies under everyday conditions.

In addition, NOW also ensures for the utilisation and dissemination of results arising from the projects being undertaken or the accompanying research, conducts public relations activities and promotes international cooperation. Since 2015, NOW has also been commissioned by the BMVI to develop national strategy plans within the scope of the EU's *Clean Power for Transport* package.

NOW is responsible for the initiation, evaluation and bundling of projects within the respective programmes and acts as the interface between government and the involved partners from research and industry. Central coordination of the projects enables the exchange of experiences within the framework of an integrated process and to exploit existing synergies. The project administrator Jülich (PtJ) undertakes the concrete handling of the BMVI funding.

ABOUT THE ELECTROMOBILITY MODEL REGIONS

NOW has coordinated over 500 individual projects since 2009 into the overall tasks and accompanying research being conducted with the scope of the funding programme Electromobility Model Regions of the BMVI. The funding approach supports cross-sector cooperation between industry, research and the public sector in order to advance the integration of electromobility into everyday life. With its current funding guidelines, the BMVI is supporting, particularly at a municipal level, the market launch of vehicles with electric powertrains along with the necessary infrastructure.

Model Regions Electromobility

Federal Ministry of Transport and Digital Infrastructure

Electromobility Model Regions – Sectors of Application
(As at December 2015*)

SECTOR OF APPLICATION	BUDGET IN THOUSANDS OF €	FUNDING IN THOUSANDS OF €
ORGANISATION/PROJECT HQS	5,512	3,045
INTERNATIONALISATION	3,174	2,925
ERA-NET	3,311	3,114
STUDIES	1,459	1,244
PUBLIC TRANSPORT – RAIL	19,019	7,633
DRIVE/TECHNOLOGY TESTING	15,395	7,772
AIR TRANSPORT	13,071	6,799
ACCOMPANYING RESEARCH	6,922	6,605
INFRASTRUCTURE	17,968	11,010
PUBLIC TRANSPORT – BUSES	18,673	10,481
PUBLIC TRANSPORT – INTERMODAL	21,936	18,298
COMMERCIAL TRANSPORTATION	51,031	26,854
PERSONAL TRANSPORTATION	66,791	40,845
TOTAL	244,262	146,626

* Figures refer to BMVI funding for projects from 2011 onwards.


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ABOUT NIP

National Innovation Programme
Hydrogen and
Fuel Cell Technology

With the NIP, the federal government has supported the path to market preparation of hydrogen and fuel cell technology since 2006. The NIP was established by the Federal Ministries of Transport and Digital Infrastructure (BMVI); Economic Affairs and Energy (BMWi); Education and Research (BMBF); and the Environment (BMUB). With a funding volume of 700 million euros, the NIP ends in its current form in 2016. The NIP is divided into four programme areas in order to advance the possibilities for various products and applications of hydrogen and fuel cell technology in equal measure. Research and development activities as well as demonstration projects are thereby implemented according to the areas of Transport and Infrastructure, Hydrogen Provision, Stationary Applications or Special Markets.

Setting the course

Within the scope of the NIP agreed by the federal government, the BMVI intends to continue the programme beyond 2016. Initial funding of 161 million euros has been initially allocated until 2018.

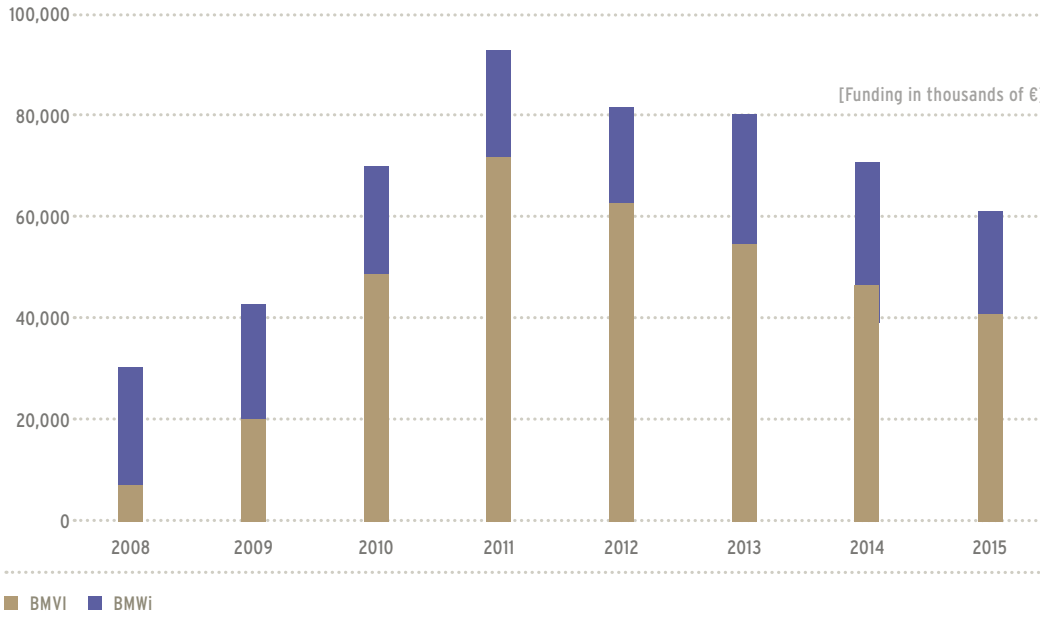
Federal Ministry
of Transport and
Digital Infrastructure

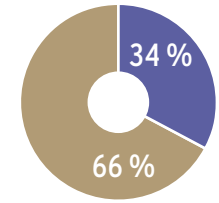
Federal Ministry
for Economic Affairs
and Energy

Federal Ministry for the
Environment, Nature Conservation,
Building and Nuclear Safety

Federal Ministry
of Education
and Research

NIP – Source of Funding *





* All data refers to approved projects.

Federal Ministry
of Transport and
Digital Infrastructure

The Federal Ministry of Transport and Digital Infrastructure in the NIP

The total share of the BMVI in the NIP amounts to 500 million euros. The NIP offers a joint framework for numerous hydrogen and fuel cell research projects from research and industry. The programme is part of the High-Tech Strategy for Germany and is incorporated in the Fuel Strategy of the federal government.

NIP – Sectors of Application
(As at December 2015*)

SECTOR OF APPLICATION	BUDGET IN THOUSANDS OF €	FUNDING IN THOUSANDS OF €
TRANSPORT & INFRASTRUCTURE	576,799	274,001
HYDROGEN PROVISION	27,603	13,895
STATIONARY INDUSTRY	73,038	38,043
STATIONARY HOUSEHOLD	117,241	55,810
SPECIAL MARKETS	115,157	54,944
INTERDISCIPLINARY THEMES	25,814	14,088
INNOVATIVE DRIVES	15,439	7,411
TOTAL	951,090	458,193

*Figures refer to BMVI funding for projects from 2011 onwards.

Federal Ministry
for Economic Affairs
and Energy

The BMWi supports application-based R&D projects within the framework of the NIP

The BMWi supports application-based R&D projects aiming to improve components and systems in the area of hydrogen and fuel cell technology. In addition, several fundamental investigations are receiving funding.

The scope of support, in accordance with the NIP, spans the full spectrum of possible areas of application of the technology: transport and infrastructure, stationary fuel cells for the supply of household energy as well as for industrial applications in addition to the special markets for the fuel cell technology.

NIP – Sectors of Application
(As at December 2015*)

SECTOR OF APPLICATION	BUDGET IN THOUSANDS OF €	FUNDING IN THOUSANDS OF €
TRANSPORT & INFRASTRUCTURE	144,494	75,181
HYDROGEN PROVISION	34,652	23,535
STATIONARY INDUSTRY	28,872	14,651
STATIONARY HOUSEHOLD	50,008	25,313
SPECIAL MARKETS	27,984	16,320
INTERDISCIPLINARY THEMES	51,510	32,565
TOTAL	337,520	187,565

* The information refers to BMWi funds for projects since 2011.

International Cooperation

Germany also wishes to do justice to its role as an active advocate and driver of a hydrogen economy on an international level. Counting among the most important partners in this regard are the USA and Japan along with several EU member states with which NOW has nurtured close ties and cooperation for many years already. China is also gaining in significance. In addition, NOW is involved in international organisations such as the Society of Automotive Engineers (SAE) as well as the International Energy Agency (IEA).

Europe

The overarching objective of the activities and partnerships on a European level is to create a comprehensive hydrogen infrastructure across Europe as well as suitable framework conditions to develop a pan-European and internationally competitive hydrogen market. The integration of renewable energy in the overall energy system is a key focus of the activities in this regard.

Further funding was made available in 2015 for the development of a European hydrogen refuelling station network through the **Trans European Network** – Transport (TEN-T) innovation programme. Among the projects approved through this programme were the two hydrogen projects »H_2Nodes – Evolution of a European Hydrogen Refuelling Station Network by Mobilising the Local Demand and Value Chains« with an overall budget of approx. 29 million euros, as well as the »Connecting Hydrogen Refuelling Stations (COHRS)« project applied for by H_2 Mobility Deutschland GmbH with a total volume of approx. 26 million euros.

In April 2015, the European Parliament passed the revision of the **Renewable Energy Directive (RED)** as well as the **Fuels Quality Directive (FQD)**. The directives define both the European goals for the deployment of renewable energy (RE) in various energy sectors (RED) as well as for quality standards of fuels and the associated reduction targets for greenhouse gasses (FQD). Interesting for hydrogen are the RED amendments that count five times the electricity from renewable energy for the transport sector and two times for »renewable liquid and gaseous transport fuels of non-biological origin«. A method to calculate the greenhouse gas reduction potential of such fuels is to be developed by 31 December 2017. A basis for the calculation of the use of hydrogen in fuel cell vehicles already exists. NOW will continue to constructively accompany the further developments regarding the methodology for the measurement of hydrogen quality in terms of the directive, in close cooperation with the relevant ministries and industry.

The **Government Supporting Group (GSG)** continued its work intensively throughout 2015. Besides the previous participants of Austria, Denmark, England, France, Germany, the Netherlands and Sweden, in the summer of 2015 two new countries – the Czech Republic and Finland could also be welcomed. It was furthermore resolved to define a structure and the content for what until now was an informal group, with Terms of Reference (ToR). NOW has been given the mandate to act as Secretariat to the GSG and to coordinate and organise all further tasks in

working groups regarding the infrastructure of alternative fuels, on behalf of the BMVI. European cooperation in this area is also subject to the implementation of the European guidelines »on the deployment of alternative fuels infrastructure« (AFI). As part of the AFI implementation, NOW was commissioned by the BMVI/BMWi to develop the »national strategy framework« for power and hydrogen and to also coordinate this with neighbouring countries.

As part of the **Fuel Cell and Hydrogen Joint Undertaking** (FCH-JU) strategic partnership, NOW is involved in three studies on the subjects of fuel cells (Fuel Cell Distributed Generation Commercialisation Study), energy storage (Energy Storage Study) as well as on the market introduction of fuel cell buses (Commercialzation Strategy for Fuel cell electric Buses in Europe). In addition, NOW is supporting the FCH JU funded project »Hydrogen Mobility Europe (H_2ME)«. Within the H_2ME project, 10 countries are receiving support totalling 68 million euros for the development and operation of 29 hydrogen refuelling stations and 300 fuel cell vehicles.

China

On the basis of the joint declaration signed in October 2014 by the BMVI and the Ministry of Science and Technology (MoST) of the People's Republic of China for cooperation in the areas of electromobility as well as hydrogen and fuel cell technology, the organisations commissioned by the respective ministries – the China Automotive Technology & Research Center (CATARC) and NOW – took up work in 2015. Besides the continuation of the existing German-Chinese Electromobility Model Regions cooperation, focus was placed strengthening scientific exchange between the two countries as well as the development of a partnership in the area of hydrogen and fuel cell technology with an emphasis on the transport sector.

As China has defined hydrogen and fuels cells as key technologies for achieving climate goals in the new Energy Development Strategy Actions Plan (2014 – 2020), the country has signalled its lofty ambitions to enter into the world's top league in this field.

In October, the second meeting of the Steering Committee between BMVI and MoST took place. Following the first such Steering Committee meeting in Beijing in 2012, it particularly provided the opportunity to engage in an exchange on a ministerial level on the current policy framework conditions in the areas of electromobility and H_2 fuel cells in both countries as well as on the continuation of the existing German-Chinese cooperation in the area of Electromobility Model Regions.

USA and Japan

Together with the US Department of Energy (DoE) and Japan's New Energy and Technology Development Organization (NEDO), NOW prepared the 3rd International Workshop on Hydrogen Infrastructure and Transportation in Tokyo as well as the public webinar. More than 60 technical experts from the USA, Japan, Scandinavia and Germany participated and discussed the current challenges for the implementation of international standards for hydrogen filling stations. An outcome of the workshop was that further capacities for H_2 quality measurement according to the international standards must be expanded on a global scale. There are currently only laboratories in the USA and Japan that can comply with these standards. No facilities exist in Germany or any other European country that would be capable of conducting these measurements.

Japan

The 2nd Annual Meeting of the Innovation for Cool Earth Forum (ICEF) took place in Tokyo in October. Among the ICEF's aims was to provide a forum for preparing for the climate negotiations of the United Nations (COP21) in Paris in December. The forum could boast high-profile attendees including the participation of Japan's Prime Minister Shinzo Abe. The subject of hydrogen and fuel cell technology in the context of climate change was discussed at the meeting. As a long-standing partner, NOW was also invited to speak and could present and position the German activities being conducted in the area.

IPHE

The International Partnership for Hydrogen and Fuel Cells in the Economy (IPHE) is a consortium of 17 member states and the European Commission with the goal of accompanying and promoting the commercialisation of hydrogen and fuel cell technology.

In 2015, a focal point of IPHE activities was on finalising the establishment of a Permanent Secretarial Office (PSO), with Tim Karlsson taking up work as Executive Director. The PSO has its headquarters in the rooms of the FCH-JU in Brussels. With the establishment of the PSO, continuous work on an international level has been assured and the tasks and goals of the IPHE can now be pursued significantly more effectively.

↗ More information can be found at: www.iphe.net.

IEA

H_2-Roadmap

The IEA presented its Hydrogen and Fuel Cell Roadmap in 2015. Leading up to this, NOW – together with the United States DoE, Japanese NEDO, the European Commission and further experts – prepared a consolidated report and was also involved in the review processes. At the official presentation of the Roadmap, the significance of fuel cell and hydrogen technology for achieving the 2°C goal was highlighted. The visibility of the subject of hydrogen could thereby be boosted on a global level and in the lead-up to the Paris Climate Conference (COP21).

Hydrogen Implementing Agreement

NOW is a member of the Executive Committee of the International Energy Agency Hydrogen Implementing Agreement (IEA HIA) and is actively involved in shaping the IEA HIA content. Scientists and researchers from around the world come together within the scope of the IEA HIA to conduct research projects together on current hydrogen fuel cell topics. The platform fundamentally provides a good basis for obtaining an overview of current global research activities and for creating and maintaining valuable connections to the IEA and other countries.

↗ An overview of the current tasks can be found here: http://ieahia.org/

STARTERSET ELECTROMOBILITY – PRACTICAL TIPS AND RECOMMENDATIONS FOR ACTION FOR MUNICIPALITIES

Vivid practical examples, checklists for the development of recharging infrastructure and further practical tips for the implementation of electric mobility projects in municipalities is what visitors to the www.starterset-elektromobilität.de website will find. Information on offer includes experiences and insights made in the Electromobility Model Regions of the Federal Ministry for Transport and Digital Infrastructure (BMVI) as well as in the accompanying research. Municipalities wishing to expand their efforts in the area of electric mobility – or those wishing to begin – can therefore benefit from the experiences and result others have already made.

No matter if battery electric or using hydrogen and fuel cells, mobility with alternative drives delivers opportunities for town and country regions alike. With the Starterset, NOW has made a contribution to spread electromobility further throughout Germany. Following its introduction in 2014, the Starterset was expanded and promoted more widely in 2015.

Starterset »on the road«

The Starterset was personally handed over on 13 occasions in 2015. A briefcase containing printed information materials as well as reference to the online Starterset content was handed over to communal representatives throughout Germany within the scope of the Electromobility Roadshow. The Starterset information was also presented by NOW staff at press conferences and at other events, with municipal representatives being encouraged to continue on their path towards electric mobility.

The general public also made use of the information available at the Electromobility Roadshow and the opportunity to conduct test drives. The electric vehicles' dynamism and suitability for everyday use impressed the Roadshow visitors. The Electromobility Roadshow was embedded in local events incorporating subjects from a spectrum that included themes such as alternative mobility, climate protection and renewable energy.

↗ www.starterset-elektromobilität.de
↗ www.roadshow-elektromobilität.de

» No matter if battery electric or using hydrogen and fuel cells, mobility with alternative drives delivers opportunities for town and country regions alike. «

HyTrustPlus

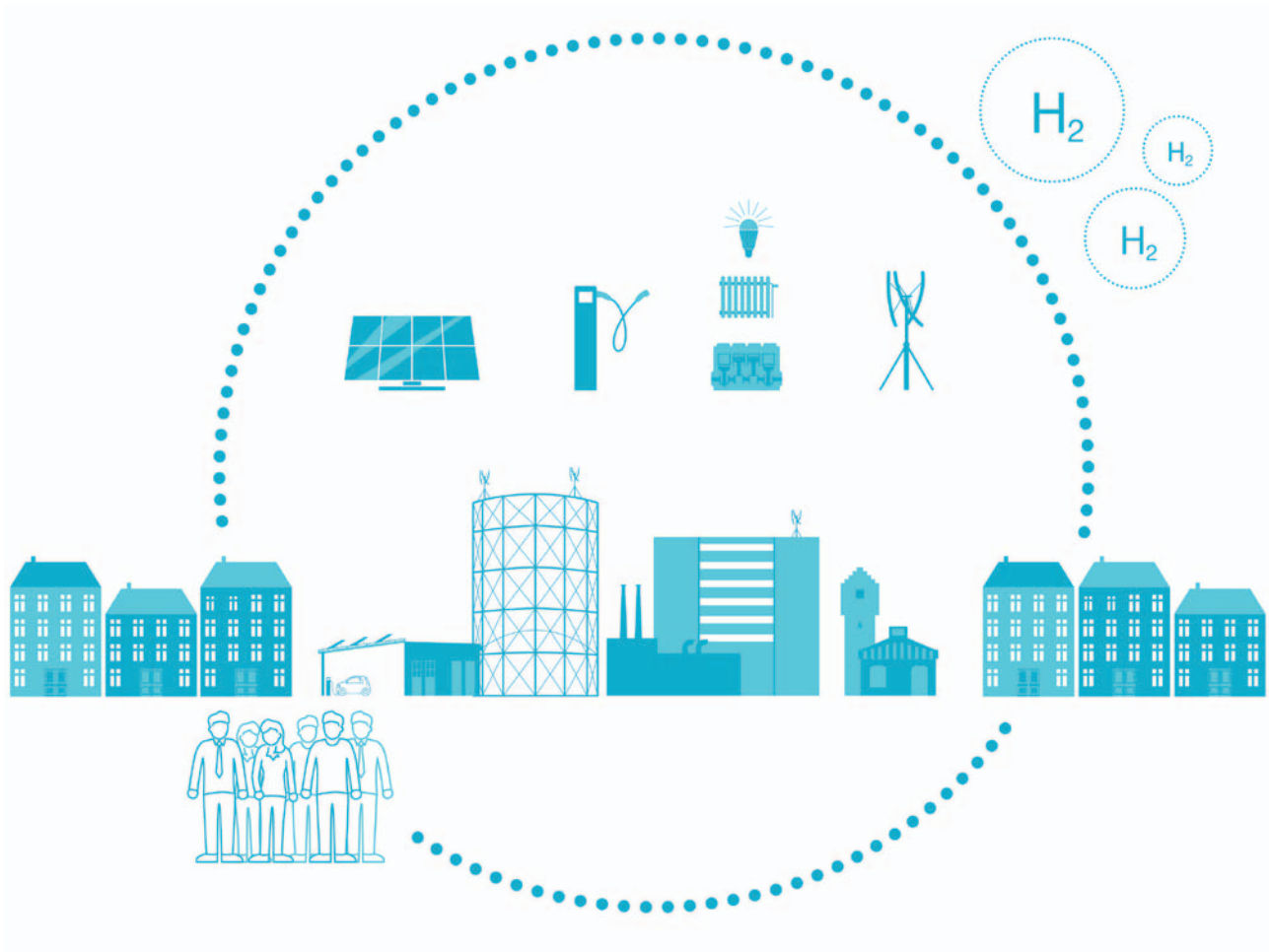
The HyTrustPlus project (2014 – 2016) informs societal stakeholders such as politicians, association representatives, companies and citizens about the diverse aspects of hydrogen and enhances their exchange with one another.

One of the results of the project is the discussion paper on business models, market outlooks and the role of politics in fuel cell and hydrogen technology in Germany. The survey of players in the hydrogen and fuel cell technology area dealt with expectations, funding options and obstacles. Survey results show that there is no common vision shared by the players, but rather individual goals. Furthermore there is the fear that the political framework conditions are deteriorating and that no direct funding will be available in the future. This is why it is vital that policy-makers declare support for the energy and climate goals in Germany and the EU.

The potential of hydrogen technologies in the context of regional energy changeovers will be analysed and discussed by players from politics and administration, city authorities, energy cooperatives, technical gas companies, financial services, research and local public transport of an administrative district in North Rhine-Westphalia (NRW). Four stakeholder dialogues took place on this issue in 2015, whose strategies for integrating the hydrogen economy in the existing and planned activities of the regional energy changeover developed not only technical, but also potential regional business, financing and operational models. In an additional three dialogues, the possible roles of the region will be teased out further until the summer of 2016.

In order to foster awareness of the issue with the decision-makers of tomorrow, the current and upcoming possibilities and associated challenges of the hydrogen economy were highlighted for school students in several learning workshops. Here smaller experiments were carried out, hydrogen itself produced, and then converted into electricity using a fuel cell in a small hydrogen vehicle. In addition visits took place to companies already working in this area.

But it is not only students learning more about hydrogen. A learning facility on the EUREF campus in Berlin will be accessible by interested members of the public and will demonstrate manufacturing, storing and user possibilities through different exhibits such as videos, posters, simulations and a miniature vehicle.



» Four stakeholder dialogues took place on this issue in 2015, whose strategies for integrating the hydrogen economy in the existing and planned activities of the regional energy changeover developed. «

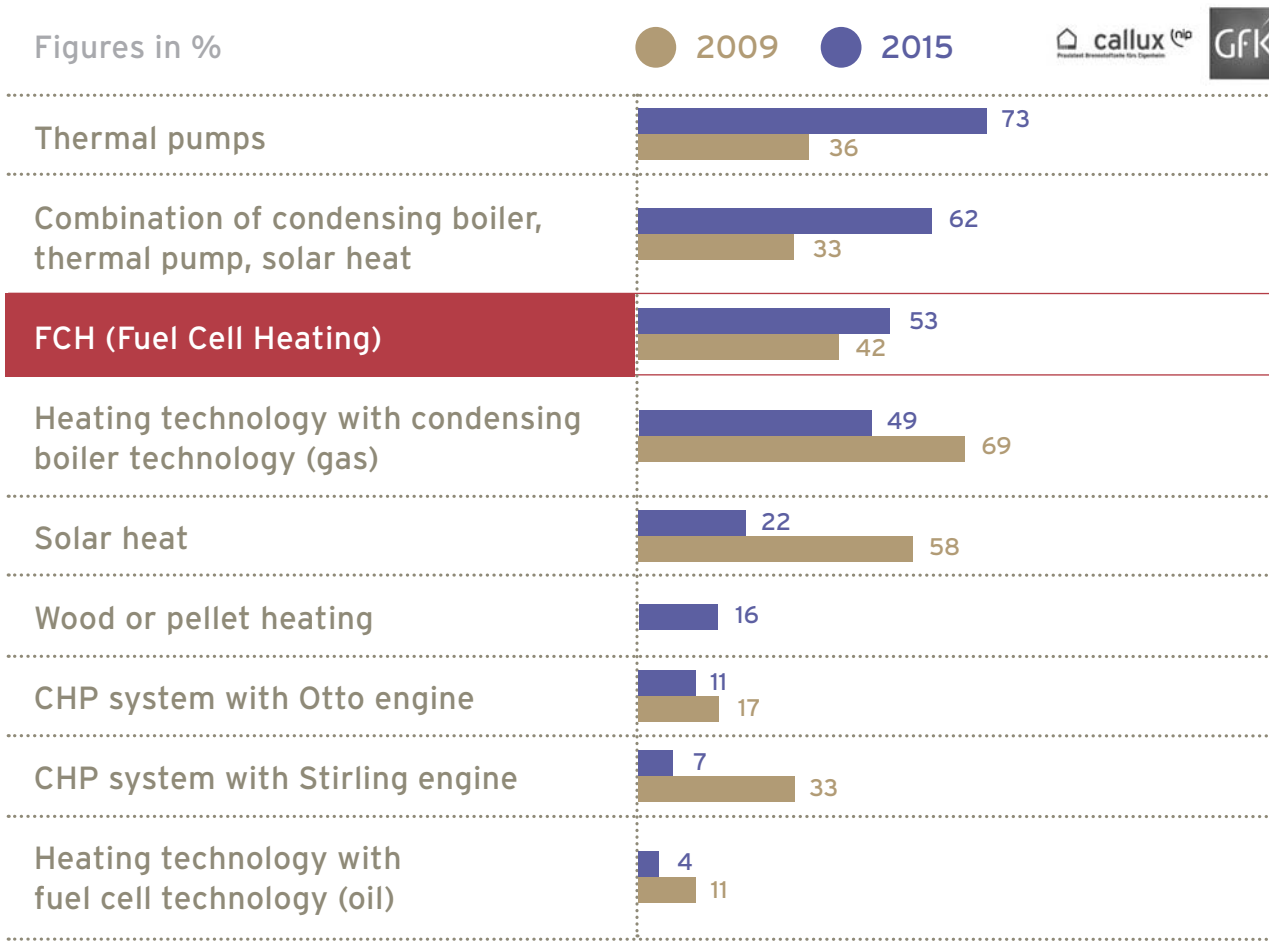
GfK market research on fuel cell heating devices

A PRODUCT WITH POTENTIAL

Within the Callux practical trial, GfK from Nuremberg examined different market participant perspectives regarding fuel cell heating devices. At the core were the target groups of multipliers, sales representatives, test customers and potential customers. The experts identified two fundamental success factors for market entry of the innovative technology: On the one hand, inexpensive credit and start-up financing from public funding and manufacturers as well as long-term subsidies and feed-in remunerations; and on the other, supplier guarantee plays a crucial role when it comes to overcoming technical difficulties. Marketing by participating players is particularly needed in order to generate end customer and sales representative interest and acceptance. Communicating the savings potential in energy costs is effective here as well as the persuasive information provision by expert partners.

Over half of installers see great market opportunity for the fuel cell. Compared to the first survey in 2009, sales representatives' estimates significantly improved by 2015. Customers find fuel cell heating devices immediately very appealing. Almost half potential end customers would seriously consider such a system in future. Attributes ascribed to the fuel cell are: substantial cost savings, environmental-friendliness and reduction in CO_2 emissions, combined heat and power production as well as using the latest technology. As a focus for future activities, GfK identifies comprehensive explanatory and information work for end customers and installers to gain trust in this new technology, and also the raising of the level of awareness of fuel cells as well as easy-to understand demonstration of the product features. According to GfK, fuel cell heating systems are already today regarded as an innovative technology of the future. The new heating devices can be used as a complementary technology to the smart home. They are small, energy efficient, inexpensive to run, simple and convenient to operate – also using a smartphone or PC. The systems can be integrated into smart home technologies, but also supply self-produced electricity for electromobility. Currently, fuel cells are too unknown by end users and installers and must first assert themselves in competition with other technologies like thermal pumps or solar energy. As a power-generating heating system, fuel cells reflect the trend towards the wish for self-sufficiency.

» Around half of installers give FC heating devices great market chances and would recommend installation to customers. «



INVOLVEMENT IN STRATEGIC PROGRAMME DEVELOPMENT

The Advisory Board

The National Innovation Programme for Hydrogen and Fuel Cell Technology (NIP) has an impressive record of achievement. The associated National Development Plan (NEP) forms the guidelines for implementation. It is developed by the advisory board and is regularly updated. The NIP has enabled a hydrogen/fuel cell sector to be established, which today consists of around 500 industrial companies including suppliers. In order to ensure successful market entry, industry representatives of the NOW advisory board are working toward an extension beyond 2016. That is why a strategy paper was drafted for the continuation of the research and development part and for implementation of the market launch of fuel cell and hydrogen technology in stationary and mobile areas.

In 2015, the advisory board handed over a catalogue of measures on the potential further development of the NIP beyond 2016 to the NIP-involved ministries, the BMVI and the BMWi. The catalogue contains depictions of possible measures and budgets for courses set, for the further development of the NIP.

Composed of the most important stakeholders from the ministeries, industrial and scientific spheres, the advisory board discusses and defines the strategic orientation of lighthouse projects as well as the associated funding priorities. Market preparation of the new technologies are to be mapped out in a holistic approach. The advisory board is therefore instrumental in the management of the entire long-term innovation programme, whose total budget comes to around 1.4 billion euro until 2016, which is almost fully earmarked in initiated projects.

According to regulations, the advisory board is composed of four representatives from the respective participating federal ministries BMVI, BMWi, BMUB and BMBF, a coordinator of the federal states as well as representatives of all industry sectors and research institutions involved in the topic. There was a change in personnel in 2015. An overall advisory board election will take place in mid-2016.

In June 2015 the advisory board hosted the general assembly on the NIP BMVI, which took place together with the BMWi's status seminar on fuel cells. Almost 400 participants were informed about political agenda-setting and plans beyond 2016, as well as about project results and advances.

Aside from fuel cell and hydrogen projects, NOW GmbH coordinates battery-electric mobility under the »Electromobility Model Regions« for a few years now. Aside from the showcases with many vehicles and the associated charging infrastructure, the five existing model regions provide high electromobility visibility. In addition NOW GmbH was commissioned with designing the mobility and fuel strategy of the federal government. Both points are covered in the advisory board.

The advisory board also advocated the continuation and support of international activities, such as the FCH JU, the H_2 Roadmap of the IEA as well as the IPHE. NOW's

The Advisory Board in detail

The board is comprised of representatives from the following 18 interest groups:

Government

BMVI: Stefan Schmitt
BMWi: Dr. Georg Menzen (Advisory Board Chairman)
BMBF: Gesine Arends
BMUB: Malte Helbig
Representative of the federal states: Martin Eggstein, Heinrich Klingenberg (without voting rights)

Science

Education: Prof. Dr. Jürgen Garche
Research & Development Helmholtz Association: Prof. Dr. Detlef Stolten
Research & Development Institutes/Universities: Prof. Dr. Alexander Michaelis

Industry / Applications

Mobility – passenger cars: Dr. Sabine Spell
Mobility – commercial vehicles: Dr. Georg Frank
Household energy supply: Andreas Ballhausen
Industry applications: Johannes Schiel
Special applications:
Prof. Dr. Werner Tillmetz
Fuel cell components manufacturing:
Dr. Uwe Maier

Infrastructure

Fuel industry: Reinald Hieronymus
Hydrogen production: Dr. Oliver Weinmann (Advisory Board Chairman)
Hydrogen provision: Markus Bachmeier
Network supply: Markus Seidel

work can thereby be thematically and organisationally linked to the plans of the EU, USA, Japan and Korea, in particular.

Dr. Georg Menzen, BMWi
(Advisory Board Chairman)

Prof. Dr. Werner Tillmetz, ZSW
(Advisory Board Chairman)

Annual Review of Events

NOW actively conducts public relations activities in order to increase the perception and public awareness of the technology and the associated products. An overview of selected events from 2015 is shown on the following pages.

27 – 28 January 2015
On-site Electromobility – 2nd Specialist Conference of the BMVI for Municipal Representatives in Offenbach

On behalf of the BMVI, the Stadtwerke Offenbach Holding and NOW invited municipal representatives to the 2nd »On-site Electromobility« Specialist Conference at »Kickers« stadium. Main topics of the two-day event included fleets, public transport and infrastructure. Together with Rainer Bomba, BMVI State Secretary, and Tarek Al-Wazir, Minister for Economics, Energy, Transport and Regional Development of the State of Hesse, around 350 participants discussed hurdles, challenges and strategies for success at the fully booked out conference. The event also coincides with the kick-off for the new Roadshow season: a good dozen or so municipalities are to be visited in 2015, as in the past year, to also provide information on-site and promote exchanges on the subject of electromobility.

Rainer Bomba, State Secretary BMVI, Tarek Al-Wazir State Minister, Horst Schneider, OB Offenbach

Around 350 participants came to the specialist conference in Offenbach

January February March April May June July August September October November December

03 – 05 February 2015
CAR-Symposium Bochum

At the 15th CAR Symposium held in Bochum, NOW is once again involved. NOW provides information on networked mobility and accompanying research in the Electromobility Model Regions.

26 – 28 February 2015
FC Expo Tokyo

NOW is part of the joint German stand at the FC Expo in Tokyo. The world's largest specialist trade fair for hydrogen and fuel cell technology offers a wide range of opportunities to expand international cooperation as well as providing a platform to communicate Germany's policy and business efforts in terms of sustainable technologies.

2015

30 March 2015
5th CPN Anniversary and 4th CPN General Assembly

Hosted by the Berlin Representation of the State of North Rhine-Westphalia, representatives of the NIP Lighthouse develop further ideas in the directions of market introduction of fuel cell applications in special segments. Global potentials are also taken into account: developing countries such as India, China as well as various African countries that often only have a poorly developed electricity network, are increasingly using fuel cells to shore up their infrastructure. The promotion of exports will therefore be high on the CPN agenda in the coming years.

06 March 2015
»HansE« starts in Hamburg

Aim of the project is the establishment of up to 50 recharging stations for electric buses over the next three years in the Hamburg metropolitan region. The Federal Ministry for Transport and Digital Infrastructure (BMVI – Bundesministerium für Verkehr und digitale Infrastruktur) supports the project within the scope of the Electromobility Model Regions. With the help of HansE, new infrastructure for electric vehicles will be created, which will be especially focused on existing P&R stations.

19 March 2015
Toyota Technology Seminar

The fuel cell Mirai stimulates several dozen journalists to attend workshops in Munich and Berlin. NOW, together with Toyota, the German Hydrogen Association as well as media representatives from the daily press and specialist publications, discuss the perspectives of the technology and look forward in eager anticipation to the scheduled expansions of refuelling stations by the government.

Representatives of the member companies celebrate the 5th anniversary of Clean Power Net (CPN).

31 March 2015

Minister for Economic Affairs Gabriel and his French counterpart visit CEP filling station

As part of the German-French Ministerial Council, Economics Affairs Minister Sigmar Gabriel and his French counterpart Emmanuel Macron visit the CEP hydrogen refuelling station from TOTAL in Heidestrasse, Berlin. Talking with representatives from industry and NOW, Minister Gabriel explains that fuel cells and batteries are intrinsic parts of electromobility and that hydrogen must be considered alongside other alternative fuels.

Dr. Klaus Bonhoff explains to Economics Affairs Minister Sigmar Gabriel and his French counterpart Emmanuel Macron the benefits of hydrogen and fuel cell technologies.

2015

13 – 17 April 2015
Hannover Messe International

Dr. Klaus Bonhoff hands over a map showing the current status in regard to the 50 refuelling stations for Germany programme to Norbert Barthle, Parliamentary State Secretary BMVI, at Hannover Messe. The stated goal is to set up 400 hydrogen refuelling stations nationally by the end of 2023. The H_2Mobility initiative, which was especially established for this purpose, is particularly active in this regard.

Companies including Air Liquide, Daimler, Linde, OMV, Shell and TOTAL belong to the consortium.

(Left to right) Dr. Klaus Bonhoff and Norbert Barthle, Parliamentary State Secretary BMVI, present the current state of play on the establishment of 50 hydrogen refuelling stations at Hannover Messe.

04 May 2015
New addition to the portfolio: Motorway filling station with hydrogen

Dorothee Bär, Parliamentary State Secretary at the Federal Ministry for Transport and Digital Infrastructure (BMVI), opens Germany's first hydrogen filling station located directly on a motorway. The new H_2 pump at the TOTAL Motorway Service Station at Geiselwind on the A3 motorway between Würzburg and Nuremberg now connects the already existing refuelling facilities in the metropolitan regions of Frankfurt/Main, Stuttgart and Munich, with one another, thereby comprising a junction for electric vehicles with fuel cells in the south of Germany.

Dorothee Bär (middle), Parliamentary State Secretary at the Federal Ministry for Transport and Digital Infrastructure (BMVI), opens the hydrogen filling station together with Patrick Schnell (CEP), Alexander Ruscheinsky (VEDA), Guillaume Larroque (TOTAL), Markus Bachmeier (Linde Group), Anton Strohofer (Autohof Strohofer – Geiselwind), Herbert Kohler (Daimler), Anja Weisgerber (CSU) and Dr. Otto Hünnerkopf (CSU) (from left to right).

29 May 2015
GreenTec Awards

The green environmental prize is awarded for the eighth time in categories such as water, air or building & housing. NOW supports the event including having a stand where information on these areas is provided.

31 May 2015
New funding guideline »Fuel cells for highly efficient combined power and heat systems«

The BMVI expands its supporting investments in fuel cell based combined heat and power systems (CHP systems) and announces a new funding guideline. A focus is on CHP systems for the energy supply of larger properties, such as for industrial sites and domestic energy supply facilities of up to 20kW electrical power.

The FC CHP guideline is to ensure a smooth transition of the fuel cell-based CHP technology from field tests to market introduction.

NOW sets up a website specifically in regard to this new guideline.

2015

Federal Minister Dobrindt at the Electromobility Conference

15 – 16 June 2015
Federal Minister Alexander Dobrindt at the National Electromobility Conference of the federal government

Alexander Dobrindt: »Electromobility must inspire emotion and stir passions to be the drive system of the future. We need further advances in the recharging station infrastructure, recharging times and range. The federal government has put together a comprehensive package of measures for this purpose. This involves that electric vehicles are privileged on the roads – which is something that we enable with the electromobility legislation than has come into effect. This involves, that more is invested to support hydrogen refuelling stations than has been in the past to develop a strong network across the country. This involves installing around 400 more electric charging points on motorway service stations by 2017. And this also involves changing over vehicle fleets – where public institutions must be pioneers and work as drivers for the development of a functioning used car market.«

National conference of the federal government on electromobility

09 June 2015
Electromobility funding guideline – BMVI calls for new proposals

New funds are being made available in the area of electromobility: based on the new funding guideline and building on the Electromobility Model Regions funding programme, the Federal Ministry for Transport and Digital Infrastructure (BMVI) supports the market introduction of vehicles with electric powertrains including the required infrastructure.

Stefan Schmitt greets participants on behalf of the BMVI.

01 – 02 June 2015
NIP General Assembly

The NOW Advisory Council invites around 400 guests including media representatives to the Marriott Hotel in Berlin to enter into an exchange on the latest projects initiated in the National Innovation Programme Hydrogen and Fuel Cell Technology (NIP). The General Assembly, which takes place in an 18 month cycle, is completely booked out – not least because the programme sets its sights firmly on the future: The goal »NIP 2.0« is in focus and gains even further impetus over the course of these two days.

Participants learnt about the latest developments in the fuel cell status seminar.

The NIP General Assembly counts around 400 participants.

2015

Together with the partners of the Daimler plant, NOW informed Members of the Bundestag from Düsseldorf (Thomas Jarzombek, CDU, 3rd right, and Andreas Rimkus, SPD, 4th right), representatives from local politics as well as the media about hydrogen forklifts that were being put into operation for the first time, along with the associated infrastructure.

03 June 2015
Mercedes-Benz plant puts trust in hydrogen

Alternatively powered forklifts being tested in Düsseldorf: following the successful take-up of operations of a combined heat and power plant and the deployment of a Mercedes-Benz B-Class F-CELL vehicle in the company fleet, the Transporter plant is now testing hydrogen as a fuel – including a mobile hydrogen refuelling station – on the plant premises. Goal: less emissions and more efficiency in logistics processes.

Norbert Barthle, Parliamentary State Secretary BMVI hands over the Starterset as part of the Roadshow Electromobility to Gerrit Elser, Lord Mayor of Giengen an der Brenz. At the Day of Electromobility, which was initiated by the »Energy & Climate Protection« and »Fahr-Rad« groups of the Local Agenda 21 group, a broad range of electric-drive vehicles could be tested, which impressed the State Secretary and other visitors alike.

07 July 2015
Dr. Klaus Bonhoff also takes along a Starterset on his visit to Oldenburg

Dr. Klaus Bonhoff, Managing Director of the National Organisation Hydrogen and Fuel Cell Technology, hands over on behalf of the BMVI the Starterset Electromobility to Jürgen Krogmann, Lord Mayor of Oldenburg

The 7-city electromobile tour of Lower Saxony's Ministry of Economic Affairs, Labour and Transportation and the »Metropolitan Region Hannover Braunschweig Göttingen Wolfsburg« used this penultimate tour stop to offer a wide range of electric-drive vehicles for test drives.

Dr. Klaus Bonhoff hands over the Starterset Electromobility to the Lord Mayor of Oldenburg, Jürgen Krogmann (middle), in the presence of Lower Saxony's Economics Minister Olaf Lies (far right).

14 July 2015
TOTAL opens hydrogen pump with innovative refuelling technology in Munich

As part of the Clean Energy Partnership (CEP), a second hydrogen pump is added to the one already existing at the TOTAL multi-energy refuelling station in Detmold Strasse, Munich. Besides standard refuelling with gaseous hydrogen (700 bar), the new pump is equipped with innovative cryo technology. Hydrogen in this aggregate state is characterised by an especially high level of storage density.

Dr. Veit Steinle, Department Head BMVI, with representatives from the CEP at the refuelling station opening.

2015

29 – 30 August 2015
BMVI open day

At the Ministry of Transport and Digital Infrastructure, NOW presents projects to interested guests about innovative energy sources with hydrogen and fuel cells as well as electromobility. Visitors use the opportunity to test CEP vehicles as well as a battery-operated BMW i3 and receive detailed information on how the techno-logies of the Callux and e4ships exhibits function. The positive resonance over the weekend provides once again a clear boost to these innovative topics.

Mobile and stationary applications were the focus of the NOW stand located in front of the BMVI on the federal government's open day.

Minister Dobrindt puts the fast-charging station into operation.

13 September 2015
Minister Dobrindt put fast-charging station into operation

Federal Transport Minister Alexander Dobrindt puts the first three fast-charging stations of a nationwide e-refuelling station programme into operation, at the Köschinger Forst service station on the A9 motorway. By 2017, a network of more than 400 fast-charging e-refuelling stations are to be up and running at motorway service stations.

10 September 2015
Hessen Fuel Cell Forum

»From wind wheel to bus wheel – synergies between energy storage systems and local public transport services« – is the title of the 14th fuel cell forum, which takes place on 10 September 2015 in the House of Logistics & Mobility (HOLM) at Frankfurt airport. The event focuses on hydrogen and fuel cell technology as a linking element between the transport and energy sector. NOW presents the current developments in fuel cell buses in Germany and Europe; in the accompanying exhibition there is also the NOW Roadshow stand, at which additional priorities from the NIP and the Electromobility Model Regions are discussed.

The Fuel Cell Forum was also accompanied by a specialist exhibition.

12 – 14 October 2015
World of Energy Solutions

Like every year, NOW supports the conference and attached trade fair. New this time is the Forum Green-2Market, which takes a closer look at the relationship between sustainability and cost effectiveness.

H_2 station in Fellbach – First fuelling of a Mercedes-Benz B-Class F-CELL. From left to right: Markus Mayer (Linde AG), Burkhard Reuss (TOTAL Deutschland GmbH), Eva Wiese (Daimler AG), Helmfried Meinel (Ministry for Environment, Climate and the Energy Sector), Thorsten Herbert, (NOW – National Organisation Hydrogen and Fuel Cell Technology), Dr. Veit Steinle (Department Head, Federal Ministry for Transport and Digital Infrastructure).

2015

01 October 2015
5th hydrogen filling station in Baden-Württemberg contributes to nationwide network

Daimler, Linde and TOTAL continue their joint plans for the expansion of the national hydrogen infrastructure. After the openings at the Geiselwind motorway service area (the first H_2 filling station on a motorway) and at two locations in Berlin, the partners now take another step towards a nationwide supply network for locally emission-free electric vehicles with fuel cells: at the TOTAL multi-energy filling station in Fellbach, Dr Veit Steinle, Director-General, Departmental Policy Issues at the Federal Ministry of Transport and Digital Infrastructure, Thorsten Herbert, Head of Programme Transport and Infrastructure at NOW and Ministerial Director Helmfried Meinel of the Baden-Wuerttemberg Ministry for the Environment, Climate and Energy, in symbolically refuel the first vehicle, a Mercedes-Benz B-Class F-CELL. The TOTAL multi-energy filling station Fellbach is already the fifth H_2 station in Baden-Wuerttemberg.

13 October 2015
H_2 Mobility partners present plans to Minister Dobrindt

Representatives of the joint undertaking H_2 MOBILITY present plans for the construction of 400 hydrogen refuelling stations by 2023 to the Federal Minister of Transport and Digital Infrastructure (BMVI). To begin, 50 refuelling stations will be built for research and development purposes. At the same time, the geographic distribution of the refuelling stations today is already following strategic criteria to cover the demands of the first commercial fleets. The BMVI will fund the further development of hydrogen and fuel cell technology until 2018 with 161 million euros.

Federal Minister Alexander Dobrindt is told of the plans to establish 400 H_2 service stations in Germany by representatives from the H_2 MOBILITY consortium.

15 October 2015
World's most efficient power-to-gas plant is launched in Hamburg

Dr. Klaus Bonhoff, Managing Director (Chair) of NOW, representing the federal government, together with Jens Kerstan, Hamburg Senator for Environment and Energy, launch the operation of the world's most efficient and compact power-to-gas plant on the HanseWerk research site in Hamburg-Reitbrook. The project facilitates the supply of hydrogen that has been generated by wind electricity into the Hamburg gas network. The aim of the joint project of E.ON and HanseWerk is to use more renewable energies in terms of the set objectives over the course of the energy turnaround.

Jens Kerstan, Hamburg Senator for Environment and Energy, receives an explanation of the plant.

29 October 2015
(R)evolution in intra-logistics with hydrogen and fuel cell-driven industrial vehicles

Hydrogen as fuel for CO_2-free electromobility is becoming reality. This development is also affecting the area of industrial vehicles such as forklifts. With the deployment of highly-efficient fuel cell technology, CO_2 emissions from industrial vehicles can be cut, productivity increased and both required warehouse space and loading times can be significantly reduced. The »Intralogistik mit wasserstoff- und brennstoffzellenbetriebenen Flurförderzeugen – am Beispiel der Produktion in der Automobilindustrie« (»Intralogistics with hydrogen and fuel cell-driven industrial vehicles – using the example of manufacturing in the auto industry«) workshop from NOW (National Organisation for Hydrogen and Fuel Cell Technology) and VDMA Intralogistics and Materials Handling, gives representatives from the sector an opportunity to discuss current issues in Berlin.

Representatives of the intralogistics sector enter into lively exchanges regarding the potentials of H_2 FC technologies at a workshop in Berlin.

2015

26 November 2015
Callux concluding event

Begun in September 2008 under the National Innovation Programme for Hydrogen and Fuel Cell Technology (NIP), the demonstration project Callux, fuel cell heating appliances for households, is successfully completed and ends with the commercial introduction of the innovative systems. Participating manufacturers Baxi Innotech, Hexis and Vaillant, together with the energy industry companies EnBW Energie Baden-Württemberg, E.ON, EWE, MVV Energie and VNG – Verbundnetz Gas, tested almost 500 fuel cell heating appliances for their efficiency. The successful conclusion of this NIP Lighthouse is celebrated by the BMVI. Around 500 fuel cell heating systems were put into operation over the course of the project. Fuel cell systems for the production of power and heat for households were developed over three product generations. It is not least due to these successful practical tests that the first fuel cell heating devices are today entering the market.

Alexander Dauensteiner (Vaillant), Prof. Wolfram Münch (EnBW Energie Baden-Württemberg), PSts Norbert Barthle, Dr. Klaus Bonhoff (NOW)

18 December 2015

Successful BMVI project Ruhrauto-e Dr. Veit Steinle, Department Head BMVI, sees it for himself

Electromobility in Bochum gains even more momentum. The Solarcar project of Hochschule Bochum (Bochum University) and Ruhrauto-e join forces. The Solarcar team focuses on the development of vehicles driven exclusively by solar energy. With this e-carsharing system, Ruhrauto-e intends to further reduce the barriers to using electric cars and thereby make them more interesting for potential users. Dr. Veit Steinle welcomes these efforts.

Dr. Veit Steinle, Department Head BMVI meets Thomas Eiskirch, Lord Mayor of Bochum, in the presence of Dr. Ferdinand Dudenhöfer, Dr. Michael Schugt, Dr. Rudolf Staiger as well as Andreas Allebrod

Futurezone Technology News / Austria / 20 August 2015

Hydrogen cars: The breakthrough has begun

Windkraft Journal / 15 October

Wind power storage: World's most modern power-to-gas plant goes into operation

Meistertipp / 16 October 2015

Callux confirms market readiness of fuel cell heating

Die Welt / 28 October 2015

How the dream of the hydrogen car is to become a reality

Energy 2.0 / 1st issue 2015

Ready for hydrogen

Der Westen / 24 June 2015

Special vehicles set the scene for electromobility

Behörden Spiegel / 16 June 2015

Electrifying public sector vehicle fleets

Wirtschaftswoche / 02 October 2015

Hydrogen to become the oil of the future

Stadt + Werk / 16 October 2015

Mobility: A network of hydrogen filling stations

Zeit Online / 26 June 2015

Fuel cell – the all-rounder electric car

FAZ.net / 08 July 2015

Green hydrogen – wind turns to gas in Mainz

Energiezukunft / 09 December 2015

Fuel cell heaters: Close to market introduction

Telematics Market / 29 December 2015

New high-performance fast-charging station for electric vehicles with extensive range

allPR.de / 13 October 2015

Fill up with hydrogen – Minister Dobrindt support expansion of German refuelling station network

Deutschlandfunk / 07 February 2015

Powertrain of the future: Opportunities abound for fuel cell technology

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